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Claims

What is claimed is:

1. A method of bending a tube through a desired curvature along its longitudinal axis, the method comprising:

5 (a) reinforcing a portion the tube with a core that allows the portion to bend but that resists buckling of the tube walls; and

10 (b) bending the reinforced portion of the tube.

2. A method as claimed in Claim 1, wherein reinforcing a portion of the tube with a core includes inserting into the tube a longitudinally bendable core that resists transverse compression, whereby the core redistributes transverse forces applied to the portion.

15 3. A method as claimed in Claim 2, further comprising removing the core after bending the reinforced portion of the tube.

4. A method as claimed in Claim 2, wherein reinforcing a portion of the tube with a core includes filling the portion with granules.

15 5. A method as claimed in Claim 4, wherein filling the portion with granules includes packing the portion with sand.

6. A method as claimed in Claim 2, wherein reinforcing a portion of the tube with a core includes the portion with liquid.

20 7. A method as claimed in Claim 2, wherein reinforcing the portion of the tube with a core includes inserting into the portion a sprung mechanism that inscribes the portion.

8. A method as claimed in Claim 7, wherein reinforcing the portion of the tube with a core includes inserting into the portion a coil spring that has an outside perimeter substantially congruent with the inside perimeter of the portion.
9. A method as claimed in Claim 2, wherein reinforcing a portion of the tube with a core includes sealing at least one end of the portion to discourage the core from coming out of the portion.
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10. A method of bending a tube as claimed in Claim 2, wherein a cross-section of the tube is polygonal.
11. A method as claimed in Claim 10, wherein the cross-section of the tube forms a quadrilateral.
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12. A method as claimed in Claim 11, wherein the tube is formed from metal.
13. A method as claimed in Claim 12, wherein the tube is formed from stainless steel.
14. A method as claimed in Claim 13, wherein the thickness of the tube sidewall is in a range between one tenth of one millimeter and one millimeter.
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15. A method as claimed in Claim 14, wherein the thickness of the tube sidewall is in a range between one tenth of one millimeter and five tenths of one millimeter.
16. A method as claimed in Claim 15, wherein the thickness of the tube sidewall is one tenth of one millimeter.
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17. A method as claimed in Claim 2, wherein bending the reinforced portion of the tube includes rolling the portion between rollers that define between them a path having the desired curvature.

18. A method as claimed in Claim 17, wherein rolling the portion between rollers that define between them a path having the desired curvature includes feeding the portion through a channel defined between the rollers that is substantially congruent with the outside perimeter of the portion.

5 19. A method as claimed in Claim 18, further comprising squaring the tube, wherein squaring includes at least one of:

(a) squaring the cross-section of the portion; and

(b) longitudinally untwisting the portion.

10 20. A method as claimed in Claim 19, wherein squaring the tube includes rolling the tube between rollers that define between them a substantially straight path.

21. A method as claimed in Claim 20, wherein rolling the tube between rollers that define between them a substantially straight path includes feeding the portion through a channel defined between the rollers that is substantially congruent with the outside perimeter of the tube.

15 22. A tube having a desired curvature along its longitudinal axis made in accordance with the method of Claim 1.

23. A tube as claimed in Claim 22, further made in accordance with the method of Claim 2.

20 24. A tube as claimed in Claim 23, further made in accordance with the method of Claim 3.

25. A tube as claimed in Claim 23, further made in accordance with the method of Claim 4.

26. A tube as claimed in Claim 25, further made in accordance with the method of Claim 5.

27. A tube as claimed in Claim 23, further made in accordance with the method of Claim 6.

5 28. A tube as claimed in Claim 23, further made in accordance with the method of Claim 7.

29. A tube as claimed in Claim 28, further made in accordance with the method of Claim 8.

10 30. A tube as claimed in Claim 23, further made in accordance with the method of Claim 9.

31. A tube as claimed in Claim 23, further made in accordance with the method of Claim 10.

32. A tube as claimed in Claim 31, further made in accordance with the method of Claim 11.

15 33. A tube as claimed in Claim 32, further made in accordance with the method of Claim 12.

34. A tube as claimed in Claim 33, further made in accordance with the method of Claim 13.

20 35. A tube as claimed in Claim 34, further made in accordance with the method of Claim 14.

36. A tube as claimed in Claim 35, further made in accordance with the method of Claim 15.

37. A tube as claimed in Claim 36, further made in accordance with the method of Claim 16.

38. A tube as claimed in Claim 23, further made in accordance with the method of Claim 17.

5 39. A tube as claimed in Claim 38, further made in accordance with the method of Claim 18.

40. A tube as claimed in Claim 39, further made in accordance with the method of Claim 19.

10 41. A tube as claimed in Claim 40, further made in accordance with the method of Claim 20.

42. A tube as claimed in Claim 41, further made in accordance with the method of Claim 21.

43. An apparatus for bending an elongated body having a predetermined cross-section through a desired curvature along its longitudinal axis, comprising:

15 (a) a housing;

(b) first, second, and third rollers, each roller respectively having an axis of rotation and a rolling surface, the rollers being rotatably mounted on the housing such that:

(i) their respective axes of rotation are substantially parallel; and

20 (ii) their respective rolling surfaces define between them a channel having the desired curvature and a cross-section substantially congruent with the cross-section of the body.

44. An apparatus for squaring an elongated body having a predetermined cross-section, comprising:

(a) a housing;

5 (b) first and second rollers, each roller respectively having an axis of rotation and a rolling surface, the rollers being rotatably mounted on the housing such that:

(i) their respective axes of rotation are substantially parallel; and

10 (ii) their respective rolling surfaces define between them a channel having a cross-section substantially congruent with the cross-section of the body.

45. An apparatus for reinforcing a portion of a tube during manufacturing, comprising a core having an outer diameter substantially equal to the inner diameter of the tube that allows the portion to bend along its longitudinal axis but that resists buckling of the sidewalls of the portion.

15 46. An apparatus as claimed in Claim 45, wherein the core is longitudinally bendable and resists transverse compression, whereby it is operable to redistribute transverse forces applied to the portion.

47. An apparatus as claimed in Claim 46, wherein the core includes a plurality of granules.

20 48. An apparatus as claimed in Claim 47, wherein the granules include sand.

49. An apparatus as claimed in Claim 46, wherein the core includes liquid.

50. An apparatus as claimed in Claim 46, wherein the core includes spring mechanism that inscribes the portion.

51. An apparatus as claimed in Claim 50, wherein the spring mechanism is a coil spring having an outside perimeter substantially congruent with the inside perimeter of the portion.

52. A stainless steel tube having a desired curvature along its longitudinal axis, a substantially polygonal cross-section and a sidewall thickness in a range between one tenth of one millimeter and one millimeter.

53. A tube as claimed in Claim 52, wherein the sidewall thickness is in a range between one tenth of one millimeter and five tenths of one millimeter.

10 54. A tube as claimed in Claim 53, wherein the sidewall thickness is one tenth of one millimeter.

55. A tube as claimed in Claim 52, wherein the stainless steel alloy is iron-chromium-nickel alloy 304.

56. A grille, comprising:

15 (a) a plurality of stainless steel tubes as claimed in Claim 52, in spaced-apart disposition; and

(b) means for connecting adjacent tubes.